

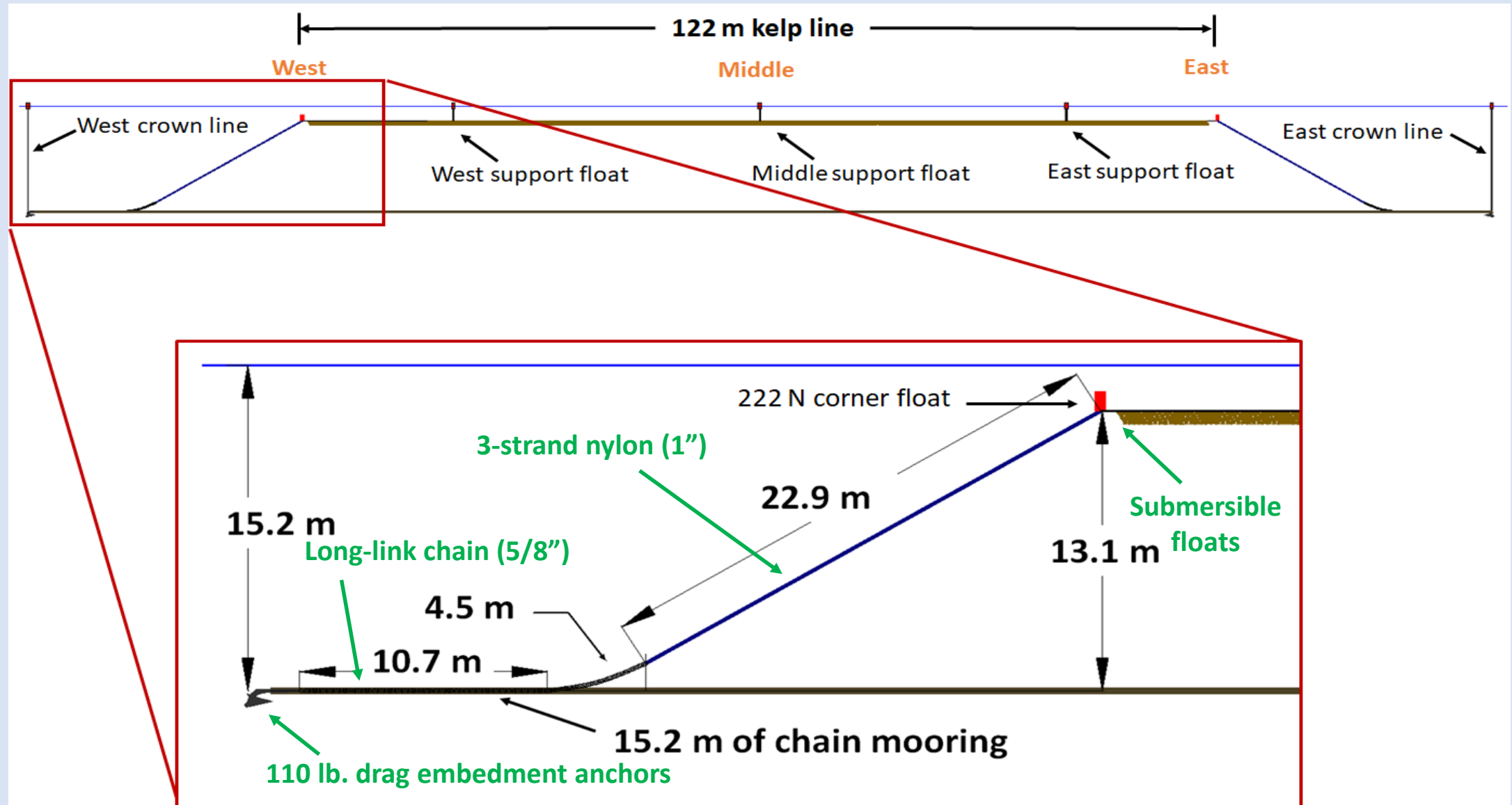
# A validated finite element modeling tool for hydrodynamic loading and structural analysis of ocean deployed macroalgae farms

1. Four years of successful kelp farming efforts in Saco Bay, Maine.
2. Close to shore but exposed!
3. In 2019, grew kelp on 122 m horizontal line, **basis for the single line validation effort.**
4. Successful deployment of multi-line systems
5. Collaboration with UNH DoE Project



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Adam St. Gelais (UNE)	Andrew Drach (Callentis)
Zach Miller-Hope (UNE)	Liz Johndrow (Atlantic Aquafarms)

# 2018-2019: Kelp-line S. Latissima, Saco Bay Maine





# Developed the “Farm in the Box Concept” for the Maine working waterfront (*St. Gelais et al. in prep*)



≈ Six 28" x 16"  
Fish Totes from  
Hamilton Marine



- 1" twisted nylon: 1850 lb working load
- 110# claw anchor: ≈ 6000 lb holding power
- 5/8" open link chain: 7000 lb working load
- Lobster buoy floats: 50 lb flotation



## Deploying kelp-line, Saco Bay Maine (Nov 2018)



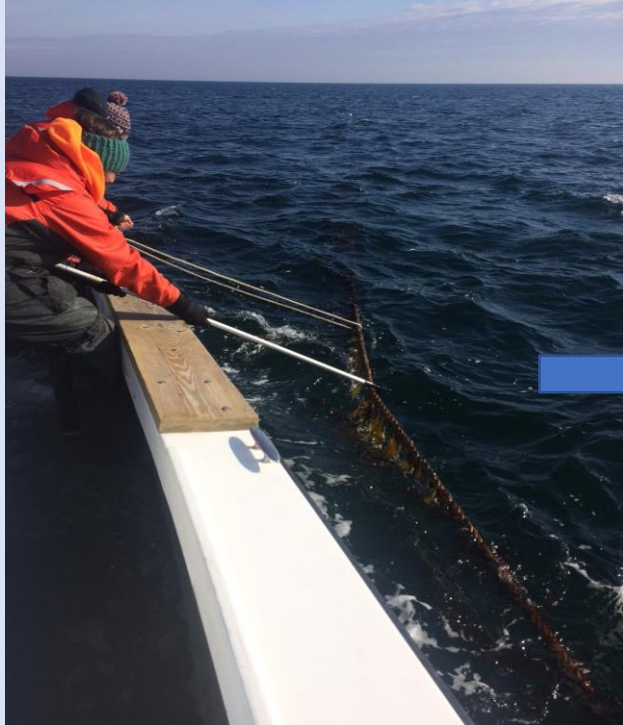
*Seeding*



*Setting the 2<sup>nd</sup> Anchor*

# Kelp-line growth: winter 2019

*{Geometric and material properties}*



*February*



*April*  $\approx 5.7 \text{ kg/m}$



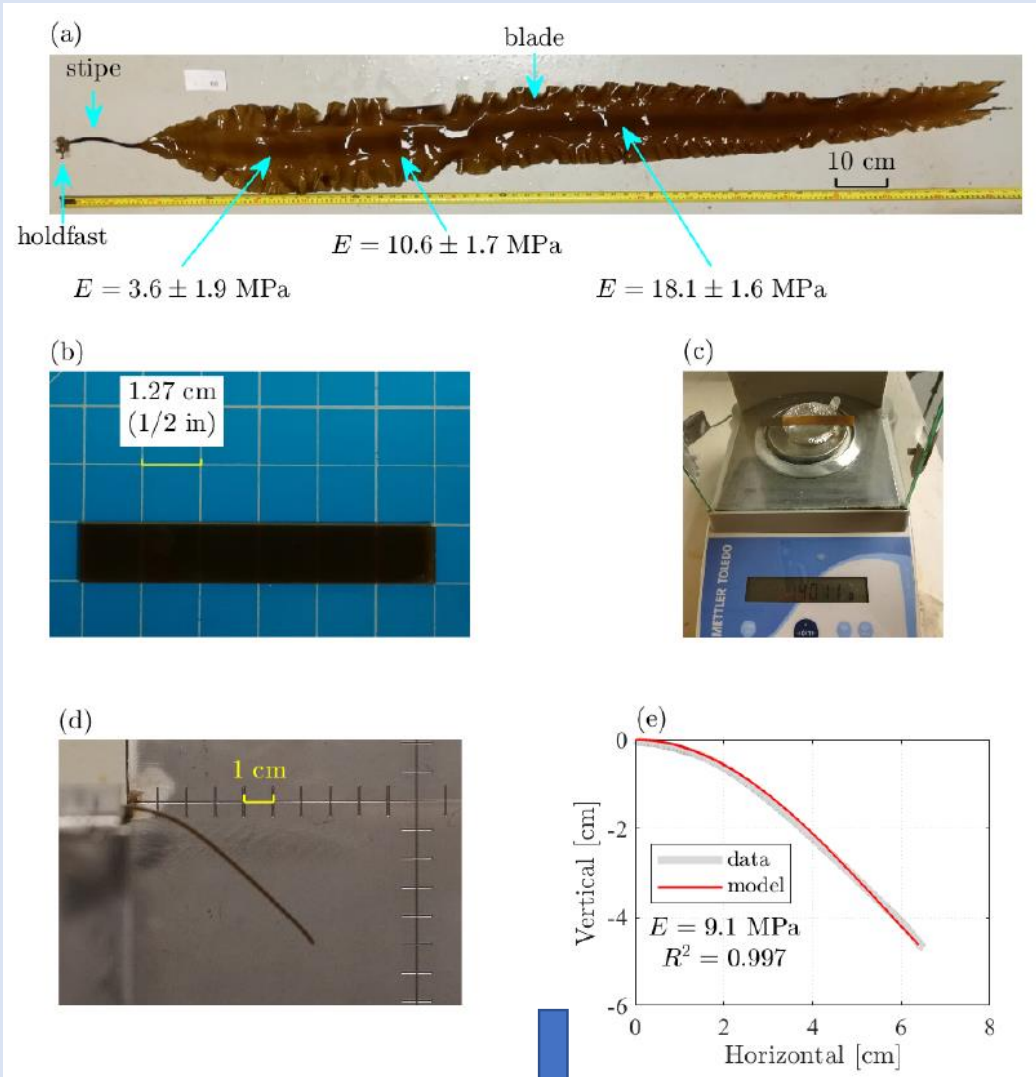
*May*  $\approx 12 \text{ kg/m}$

*Instrumentation deployment: 24-April-19 to 01-May-19*



# Geometric and material properties

## *Mass density and flexural rigidity*



$$\text{Flexural Rigidity} = EI = \frac{wl^4}{8\delta_{blade}}$$

$$W = \frac{\rho_{kelp}gV}{l}$$

$$I_{Cross-section} = \frac{1}{12}bt^3$$

$\rho_{kelp} \rightarrow \text{Most critical}$

**Goal: Sub-meter, discretized beam elements**

